BACKGROUND OF THE INVENTION

My invention relates to an improved garment seam and method for making the seam. More specifically, the improved seam of my invention is bonded together with a molten polymer because the method of my invention uses a low melt sewing thread as one of the threads used to sew the seam. Upon heating the finished seam the low melt thread melts and bonds the garment fabric together. It also coats and bonds the conventional high melt sewing thread, which is sewn in conjunction with the low melt thread, to the fabric and thus prevents unraveling of the stitch. My invention can be used in any garment seam, including the side and French seams of a dress shirt or in trouser seams or in skirt hems or in any article made of fabric.

Bonding of seams using molten polymers is known to the art of garment manufacturing, as exemplified by U.S. Patent No. 6,079,343. This patent teaches the placement of an adhesive strip or tape inside the seam before the seam is sewn with conventional high melt threads in an attempt to produce a shirt garment with seams that are pucker-free. The patent teaches that after the tape is melted, the adhesive bonds the fabric in the seam to produce a smooth and pucker free seam even after multiple laundering operations. Unfortunately, the use of such an adhesive strip not only adds additional material cost to the manufacture of garments, it significantly increases the "standard minute value" associated with the manufacturing process. This value is a measure of the man hours it takes to assemble a garment. Higher values translate directly into higher manufacturing costs. Manufacturers work very hard to reduce the standard minute value associated with a particular garment's construction. Another drawback when using the adhesive strip is the extra time it takes the sewing machine operator to position and align the strip in the seam. In essence, this is an extra or separate manufacturing step.

Another limitation of the adhesive tapes or strips used in prior art processes is that when they melt the adhesive only bonds fabric to fabric. There is no way for the

molten polymer to coat the conventional high melt sewing threads used to stitch the seam, let alone cause these threads to bind directly to the seam fabric. As such, the prior art tape cannot prevent or reduce “stitch run back,” which is one cause of high “return to manufacture” (RTM) values associated with a garment's manufacture. Like the standard minute value, a high RTM is not desirable in that it results in increased cost to the manufacturer. “Stitch run back” occurs when a stitch is missed during the sewing of a seam or hem and the stitch begins to unravel, thus causing the seam to fail. Yet another disadvantage of the adhesive tape is the degree of difficulty in placing it in small diameter seams, such as in a French seam or a trouser seam. Because of the stiffness of the tape, it is very difficult to align the tape to follow the tight radius of curvature of such seams without causing the tape to bunch.

Clearly, the art is in need of a low cost and efficient solution to form strong, pucker-free seams in garments without the attendant disadvantages of adhesive tape and further that reduces the RTM for a given garment.

OBJECTS AND BRIEF SUMMARY OF THE INVENTION

It is therefore a general object of my invention to provide a garment seam, especially the side or French seam regions of a dress shirt or the hems on trousers or skirts, and a method for making the seam which will obviate or minimize difficulties of the type previously described.

It is a specific object of my invention to provide a garment seam and method for production which will reduce the standard minute values of garments and that will produce a pucker-free seam.

It is another object of my invention to provide a pucker-free garment seam and a method of production of the seam which lowers RTM values.

It is still another object of my invention to provide a strong garment seam and method for production that can withstand numerous laundry cycles and prevents accidental seam failure.

It is yet another object of the invention to provide garment side and French seams and a method for production which provides for a cost effective solution to the disadvantages associated with the use of adhesive tapes and strips.

Finally, another object of my invention is to provide a means to the bond conventional high melt sewing thread that is used to stitch the seam to the fabric in the seam to prevent stitch run back.

Accordingly, my invention is directed to an improved garment seam whereby a combination of low melt sewing thread and conventional high melt sewing thread is used in a sewing machine to stitch the seam together. Once the seam is sewn together with the combination of low and high melt threads, the seam is subjected to a sufficient amount of heat, and if needed, pressure, to cause only the low melt thread to

soften and melt. The melted thread behaves like an adhesive as it flows over the surfaces of fabric in the seam thereby permanently bonding first and second garment components together along the seam. The melted thread also coats and bonds the high melt sewing thread to the fabric, which then prevents and significantly reduces stitch runback. My invention also relates to an improved method for creating a seam that is durable, pucker-free, and resists accidental failure. The method involves stitching the seam using at least one low melt sewing thread in combination with at least one high melt sewing thread, and then subjecting the seam to a heating step to melt the low melt thread so that it bonds the fabric and the high melt thread together as well as bonding fabric to fabric.

BREIF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following detailed description of preferred embodiments thereof taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a pictorial view of a shirt having at least side and French seams produced in accordance with my invention;

FIG. 2 is a close-up view of the side and French seams of the dress shirt depicted in FIG. 1 in which the seams have been produced in accordance with my invention;

FIGS. 3 through 5 depict cross-sectional views the seam of my invention illustrating one method for producing the seam in a garment in accordance with a preferred embodiment of my invention; and

FIG. 6 is a pictorial view of a portion of an industrial overstitching industrial sewing machine showing both high and low melt sewing threads laced for sewing a seam of my invention.

DETAILED DESCRIPTION

The term "fiber" as used herein refers to a fundamental component used in the assembly of yarns and fabrics. Generally, a fiber is a component which has a length dimension which is much greater than its diameter or width. This term includes ribbon, strip, staple, and other forms of chopped, cut or discontinuous fiber and the like having a regular or irregular cross section. "Fiber" also includes a plurality of any one of the above or a combination of the above.

The term "filament" as used herein refers to a fiber of indefinite or extreme length such as found naturally in silk. This term also refers to manufactured fibers produced by, among other things, extrusion processes. Individual filaments making up a fiber may have any one of a variety of cross sections to include round, serrated or crenular, bean-shaped or others.

The term “yarn,” as used herein refers to a continuous single ply or strand of textile fibers, filaments or material that can be used to form multi-ply products. The terms "thread" or “sewing thread” refer to two or more plies of yarn in a form suitable for processing on any type of sewing machine that is used in the manufacture of garments. Thread can occur in a variety of forms to include a spun yarn consisting of staple fibers usually bound together by twist; a multi filament thread consisting of many continuous filaments or strands; or a mono filament thread which consist of a single strand. Typically, the thread or sewing thread refers to the final product that is used in a sewing process, whereas yarn is a more generic term and can refer to the precursors used to manufacturer the final thread.

The terms "air entangling" or “air texturizing” as used herein refers to subjecting one or more yarns to an air jet for the purposes of intermingling the strands from each of the yarns to produce a single yarn or a multi-ply yarn composite that is then finished to produce a sewing thread. For example, in my invention both a low melt yarn and a conventional high melt yarn can be fed to an air texturing machine to form a composite

yarn that exhibits final properties that are a mix of the individual yarn properties. A composite or compounded thread of both high and low melt yarns may be formed in various ways. In one way a continuous filament low melt yarn can be combined with one or more ends of a continuous filament high melt effect yarn with the filament ends being combined during a texturing operation, such as air jet texturing, false twist texturing, twisting, prior twisting, conventional covering and the like. Depending on the apparatus used to perform air entangling or jet texturing, it may be necessary to modify the process to prevent the entangled composite yarn from being exposed to temperatures that may melt the low melt yarn component. Such modification can include avoiding heated godets or manipulation of temperature settings to keep the maximum temperature below the melting point of the composite yarn. In a second approach, low melt and high melt staple fibers may be homogeneously mixed or blended, then processed according to standard staple yarn processing techniques. Another approach is to use a low melt staple and to spin the staple around a high melt core. However, in its simplest embodiment, my invention involves a physical combination of one or more sewing threads composed of 100% low melt synthetic polymer with one or more conventional sewing threads having a higher melting point in a stitch using a conventional sewing machine and then subjecting the stitched seam to a heat treatment to melt the low melt sewing thread. This is illustrated in FIG. 6.

As used herein, the term "low melt" refers to a yarn or sewing thread constructed of a material having a melting point that allows it to be used on commercial heat setting equipment such that it melts and becomes flowable to an extent that the melt extends beyond the location where it was sewn and causes the fabric in the seam to bond to itself. Various examples of such materials are known in the art. Preferably, the low melt yarn will have a melting point of between about 40 ° C to about 200 ° C. More preferably, the low melt yarn has a melting temperature between about 85 ° C to about 120 ° C. Desirably, the low melt yarn is comprised of nylon, polyester, polyethylene, a polyethylene-based copolymer or another thermoplastic material such as polypropylene or any synthetic cross-linkable polymer. Alternatively, the low melt yarn or thread can be composed of a mixture of these various polymers. Regardless of the specific

polymer chosen, the key to my invention is that the melting point of the low melt thread must be less than that of the high melt thread such that when the seam is subjected to the heating step only the low melt thread melts. A suitable low melt thread is composed of nylon and is available from Thornton, Kelly & Co., Yorkshire, UK. As mentioned, the low melt thread need not be comprised entirely of fusible material such that the entire thread would melt. For example, the low melt thread could be comprised of a high melt core and a low melt sheath. The low melt sheath may be applied using a co-extrusion process or spinning process. Alternatively, the low melt thread may be a multifilament construction made of some low melt strands and some non-low melt strands. Either of the options just discussed is acceptable so long as a sufficient amount of the low melt fiber is presented for bonding to the fabric in the seam of my invention during heat setting and to bond the high melt thread to the fabric.

In the method of my invention a conventional industrial sewing machine will be set-up with at least one low-melt thread and at least one conventional high-melt thread, however, it is within the scope of my invention that the at least one thread is a composite of high and low melt yarns or strands. FIG. 6 illustrates a thread configuration on a portion of a 3-thread overstitching sewing machine **65** where looper position **67** has two threads **61** and **63**, where **63** is a conventional high melt thread and **61** is a low melt thread. Needle **66** is threaded with high melt thread **62** and looper thread **60** is also a high melt sewing thread. When the seam is sewn, the low and high melt threads are intermingled to make a conventional 3-thread chain stitch, however, because threads **61** and **63** are threaded together through looper **67,** the resulting stitch actually has four threads, with the low melt thread **61** intertwined in the stitch with the high melt threads **63**, **62**, and **60** in a completed stitch. Of course, the low melt thread could likewise be added in the other positions or in all positions. The "high melt" thread is intended to be defined by a composite of fibers or filaments having a melt temperature greater than the melting point of the low melt thread or thread component. Any conventional sewing thread that meets this melting point criterion can be used, including those made of synthetic and natural materials. Also, in any composite or blended yarn or thread, the high melt constituent should also have a composite melt

temperature of at least 10 to 20 ° C above that of the low melt constituent. Acceptable high-melt threads include those manufactured by American & Efird under the brand name PermaCore and Wildcat.

Referring now to the drawings and particularly to FIG. 1, there is a picture of a dress shirt **10** and having a front panel **12** and a rear panel **14** forming the front and back portions of the shirt **10**. A side seam **16** produced in accordance with my invention joins the front and back panels into a completed shirt garment. French seam **23** produced in accordance with my invention joins the sleeves to the back and front panels.

FIGS. 3 through 5 show the progressive production steps for producing seams **16** and **23** in accordance with a preferred embodiment of my invention. Of course, my invention works equally well on all types of seams, including hems in skirts and trousers. The following description is for illustrious purposes only and is not intended to limit the application of my invention. In general, creating a seam of my invention involves a method whereby the seam construction is composed of a first garment component **18** and a second garment component **20**. In the side seam **16** embodiment of the present invention, the first garment component **18** comprises an edge of the front panel **12** of the dress shirt **10** and the second garment component **20** is the edge of the rear panel **14** of the dress shirt.

As viewed in FIG. 3, the first garment component **18** has a first or upper surface **22** and a second or lower surface **24**. These surfaces correspond to an outer and inner surface respectively of the shirt panel **12**. The second garment component **20** also has a first or upper surface **26** and a second or lower surface **28** as viewed in FIG. 3. These surfaces correspond to an inner and outer surface respectively of the shirt panel **14** as seen in FIG. 3.

In order to form seam **16** in accordance with the invention, as depicted in FIG. 3, an edge portion **36** of the first garment component **18** is reverse folded such that the

first surface **22** of the first garment component **18** abuts against the upper surface **26** of the second garment **20**. An edge **40** of the second garment component **20** is positioned within the reverse fold of the first garment component such that the first surface **22** of the first garment component **18** folds around and abuts the edge of the second garment component **20**. A set stitch **38** can be used to attach the components together as depicted in FIG. 3. In other instances, a set stitch is not utilized and only final top stitches are utilized to bind the components together. In fact, any method that holds the folded fabric together can be used until the final stitching operation is completed.

As shown in FIG. 4, the second garment component **20** is reverse folded over edge portion **36** of the first garment such that the first surface **26** of the second garment component **20** abuts the second surface **24** of the first garment. In this position, two top stitches **40** and **42** are used to securely and permanently sew the first **18** and second **20** garment components together. The first stitch **40** preferably extends through the second garment component **20**, along and through an edge of the reverse folded portion of the first garment component **18**, and edge **44** of the second garment component **20**, and through the first garment component **18**. The second stitch **42** preferably extends through the second garment component **20**, along and through the folded portion **36** of the first garment component **18**, the edge of portion **44** of the second garment component **20** and the unfolded portion of the first garment component **18**.

The stitches used to secure the seams together can be made using any type of sewing machine. Typical machines would include a cover stitch, a chain stitch, and an overlock machine. Each of these types of machines employs two or more thread feeds and one or more needles. FIG. 6 illustrates a three thread, single needle, chain stitch sewing machine. In some cases it is possible to physically feed a low melt thread along side one of the three conventional high melt threads. For example, in FIG. 6, each of the threads **60**, **62**, and **63** could be conventional high melt sewing threads and thread **61** would be a low melt thread. The low melt thread could be combined with any or all of the conventional threads. Either the set stitch **38** or top stitches **40** and **42** must contain at least one thread comprising a low-melt yarn and at least one conventional

high-melt thread. Preferably, although not required, both types of stitch contain at least one low-melt thread. The initial set-up of the commercial sewing machine will dictate whether each stitch type contains a low-melt thread.

As shown in FIG. 5, the production of the improved seam **16** of the my invention is completed with the application of heat, and if needed, pressure. Both temperature and pressure application is schematically illustrated by directional arrows **48**, to the seam or in an opposite direction if the seam type dictates a reverse direction. Although my invention is not limited to how the temperature (and, if needed, pressure) is applied to the seam, one convenient method is accomplished with an iron pressing process. In addition to ironing and pressing, other processes that impart the required heat to melt the low-melt sewing thread can be used, for example, any direct heat method, ultrasonic, steam or hot plate. For improved control and quality this process is usually carried out on a heated press with a temperature of up to the softening point of the high melt thread, which could be as high as 200 $^{\circ}$ C. Clearly, the maximum temperature and time of heating will be function of the fabric composition, the type of low and high melt threads, and the nature of the folded seam itself. The exact heating process used in my invention is not critical provided that the fabric is not damaged by the heat and that the conventional threads do not melt. The applied heat, and pressure when used, causes the low melt thread components of the stitch(es) to melt and flow into and around the folds of the seam acting like an adhesive to bond the surfaces **22**, **24**, **26** and **28** of the first **18** and second **20** garment components. That is, the melted low-melt thread flows onto and into the fabric interstices of the reverse folded portion **36** of seam **16,** and in and around the high-melt conventional threads which are unaffected by the temperature treatment process. This is beneficial because the molten low-melt yarn acts to coat the high-melt thread and bonds it to the surrounding fabric. Such a thread/fabric bond is highly desirable because such a seam resists the potential for stitch runback which typically occurs when a skipped stitch occurs, thus leading to stitch unraveling. Bonding of the high melt thread to the fabric prevents the stitch from unraveling. Significantly, during the ironing/pressing process, the flowing molten low melt yarn becomes interposed in the interstices of the garment fabric of the first **18** and second **20** garment

components. This is advantageous because it creates a very strong bond between the surfaces of the garment components along the seam **16** and around the stitches **40** and **42**. It is this bond that prevents seam degradation during subsequent laundering operations. In particular, because the first and second garment components are bonded together along the seam **16**, they can not pull apart during laundering and, therefore, buckling of the seam fabric located between the stitches **40**, **42** will be prevented. Any tendency of the threads to shrink at a rate different from the fabric is offset and prevented by the bond created by the melted low-melt thread components of the stitches. If an ironing/pressing process is used, this will also compresses the seam 16 to reduce the seam thickness, compare FIGS. 4 and 5.

The distance **50** between stitches **40** and **42**, as shown in FIG. 5, defines the seam width. For maximum seam strength it is desirable to have the molten low-melt thread flow over the entire surface of the seam width **50**. This will ensure complete bonding of the reverse folded portion **36** of the first garment component **18** to the first surface **26** of the second garment component **20** and the threads **40** and **42**.

Although the specific embodiment as shown in the Figures is directed to a side seam of a dress shirt, it is to be understood that the seam and method for production of the present invention can advantageously be utilized for a variety of seams, for example in various seams of shirts or other garments such as trouser and skirt hems, for example. Accordingly, the seam and method depicted in the Figures is only an exemplary seam and is not intended to limit the scope of the invention.

In describing my invention, reference has been made to preferred embodiments and illustrative advantages of the invention. Those skilled in the art, however, and familiar with the art of garment manufacturing, will recognize additions, deletions, modifications, substitutions and other changes which fall within the purview of the subject invention.